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Impact of fried foods on macronutrient intake, with special reference to fat and protein

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SUMMARY

Impact of fried foods on macronutrient intake, with special reference to fat and protein.

Thermal treatment of protein is known to reduce protein quality and the destruction of certain amino acids. Fish and chips still remain a popular food source in Britain. Little work has been done on the changes in protein quality during fish frying. The paper will present results obtained from the assessment of protein quality using net protein utilisation (NPU) in fried and steamed fish. Weanling male Sprague-Dawley rats were given stock diet (RM1 expanded, SDS Ltd., Witham, Essex) for 7 days at 30 days of age, groups of four were offered one of four diets that differed only in the type of fish and processing used. Diets contained 200g of fish protein, 550g carbohydrate (400g sucrose and 150g corn-meal), 50g mineral and vitamin mix and 200g fat/kg diet. The different fish species used were Cod and Plaice and the processing used was either steaming or frying. Although a fall in NPU was noted in fried fish compared to the steamed fish these changes in NPU could be reduced if the fish was covered with batter prior to frying.

KEY-WORDS: Fried fish – Nutrient losses – Protein quality.

1. INTRODUCTION

All foods we consume, if broken down to their chemical constituents, are composed of the following «macronutrients». These are:

(a) protein
(b) fat
(c) carbohydrate
(d) fibre (non starch polysaccharide)
(e) water

It is well known that the proportion of these constituents varies markedly between foods (e.g. compare the composition of butter with that of bread). This paper will concentrate on two aspects of fried foods. Firstly, the contribution fried foods make to our total dietary fat intake. Secondly, the impact thermal treatment (during frying) has on protein quality of fried fish. Two diverse approaches are needed to answer these questions. In order to answer the first question, it is necessary to examine the dietary patterns (food intake patterns) of people and determine what foods make a significant contribution to their nutrient intake. In order to answer the second question, a standard method to assay protein quality needs to be established. Thus, this paper will present results from both a «field» and «laboratory» based investigation.

2. DIETARY FAT INTAKE: DO FRIED FOODS PLAY A SIGNIFICANT ROLE?

A reduction in dietary fat intake remains a dominant theme in most dietary guidelines the world over. Indeed in the UK, the need to reduce both total fat and saturated fat has often been emphasised (DHSS, 1994). Table I illustrates the UK guidelines for saturated fat, fibre, non starch polysaccharide and carbohydrate intake. Similar guidelines exist in other European countries (Gibney, 1990). It is now well recognised that excess fat and low fibre intake increases the risk of many degenerative diseases, notably Coronary Heart Diseases (CHD), Cancer and Hypertension (DH, 1992).

Table I
Dietary Reference Values for fat and carbohydrate for adults as a percentage of daily total energy intake (percentage of food energy)

	Individual minimum	Population average	Individual maximum
Saturated fatty acids		10 (11)	
Cis-polyunsaturated fatty acids		6 (6.5)	10
n-3	0.2		
n-6	1.0		
Cis-monounsaturated fatty acids		12 (13)	
Trans fatty acids		2 (2)	
Total fatty acids		30 (32.5)	
TOTAL FAT		33 (35)	
Non-milk extrinsic sugars	0	10 (11)	
Intrinsic and milk sugars & starch		37 (39)	
TOTAL CARBOHYDRATE		47 (50)	
NSP (g/d)	12	18	24

The study of food intake and dietary patterns in different societies is a central theme in nutritional research. Food intake studies in different societies have played a pivotal role in developing our understanding of the links between nutrient intake and disease outcome (WHO, 1990). For more than half a century food intake studies at the population level, have been systematically conducted in the UK. This valuable resource may be used to examine the contribution fried foods make to total fat intake.

It has often been suggested that fried foods have a detrimental and significant influence on our total energy and fat intake. Remarkably, this view is based on anecdotal observations rather than a critical review of the literature. In the UK the most popular «fatty foods» consumed include chocolates, sausages, potato crisps, potato chips and fried fish (Henry, 1996). Whilst it is true that all the foods listed above contain fat, the amount of fat present and energy content of these foods show remarkable variability. For example, Tables II/III show the changes in fat and energy content during the preparation of fried potato chips, crisps and fish. There is a 3-4 fold increase in energy content of fried potatoes (potato chips) and an 8 fold increase in the energy content of potato crisps when compared with raw potatoes. In contrast, there is a modest 2 fold increase in energy content of fried fish. Moreover, there is considerable variation in the final fat content of fried chips (French Fries), depending on the time of cooking and the type of fat used for frying (Table IV). Thus the assumption, that all fried foods are extremely high in fat and energy content may be an over simplification.

Table II

Gross Composition of Potato Products (per 100g)

Potato	Moisture (g)	Protein (g)	Fat (g)	CHO (g)	Energy (Kcal)	Energy (kJ)
Potato (Raw)	82	1.7	0.3	16.0	70	298
Potato Crisps	1.9	5.6	37.6	49.3	546	2.275
Potato Chips (French Fries, Retail)	43.8	3.3	15.5	34.0	280	1.174

Table III

Gross Composition of Fish Products (per 100g)

Fish	Moisture (g)	Protein (g)	Fat (g)	CHO (g)	Energy (Kcal)	Energy (kJ)
Cod (raw)	82.1	17.4	0.5	0	76	322
Cod (fried in batter)	60.9	19.6	10.3	7.5	199	834

Table IV

Chemical Analysis of Fried Foods

		Water (g)	Protein (g)	Fat (g)	Carbohydrate (g)	Energy (kJ)
Cod	Raw	82.4	16.7	0.6	0.0	306
	Fried (sunflower oil)	54.9	16.1	15.4	11.7	1.031
Chicken	Raw (meat & skin)	64.4	17.6	17.7	0.0	954
	Fried (Breaded veg. oil)	53.2	18.0	12.7	14,8	1.013
Old Potatoes	Raw	79.0	2.1	0.2	17.2	318
	Fried Chips Homemade, corn oil	56.5	3.9	6.7*	30.1	796
	Retail, veg. oil	52.3	3.2	12.4	30.5	1.001
	Fine cut, Frozen in corn oil	26.0	4.5	21.3	41.2	1.524

* Homemade chips are of variable fat content and is dependent on a number of factors relating to preparation.

Table V illustrates the consumption of various convenience vegetables in the UK per head per week. Of the 19.6 ounces (approximately 555 g) of convenience vegetables consumed per week, only 30% of the total convenience vegetable products is derived from fried potato based foods. This represents a modest contribution of fried potato products to the total food intake. Figure I shows the results of a survey conducted in Brinnington, UK on the frequency of potato chips consumed. Whilst a very small minority of people age between 15 and 40 years consumed chips daily, most appeared to consume potato chips only once a week. Thus the amount (quantity) (Table V) and frequency of consuming potato chips (Figure I) is so modest in the UK that it is unlikery to make a major contribution to total fat intake in the population at large. Table VI shows the major food sources of dietary fat and cholesterol intake in the UK. It is clear that milk, dairy products, fat spreads and meat are significant contributors to the fat intake. Thus any strategy to reduce fat intake in the diet should concentrate on the above foods rather than divert attention towards foods such as potato chips and fried fish. Despite the clear evidence presented above, health workers and some nutritionist still persist in proscribing the consumption of all fried foods. The concept of «tyranny of health» (i.e.: don't eat this do eat that) has generated considerable interest & debate (Fitzgerald, 1994). It is always useful to remember the aphorism «There are no good and bad foods but merely good and bad diets.»

Table V

Consumption of Convenience Vegetable Products. (oz / week / head)

	Consumption (ounces)[a]		
	1983	1992	1993
VEGETABLES:			
Crisps, potato snacks and other potato products	0.93	1.47	1.55
Canned vegetables	9.70	9.15	8.47
Chips excluding frozen	0.90	0.83	0.97
Frozen chips and other frozen convenience potato products	1.75	3.26	3.44
Frozen vegetables excluding potatoes	3.17	3.74	3.73
Other vegetable convenience products	0.54	1.33	1.44
Total convenience vegetable products	**16.99**	**19.78**	**19.60**

Table VI

Major sources of dietary fatty acids and cholesterol in the UK diet (per person per day)

Food	SFA	*cis*-MUFA	*trans*-fatty acids	n-6 PUFA	n-3 PUFA	cholesterol
	g	g	g	g	g	mg
Milk and milk products	8.5	3.3	0.5	0.2	0.1	41
Fat spreads (including butter and margarine)	6.2	3.0	1.4	2.4	0.3	30
Meat and meat products	8.3	8.3	0.9	2.0	0.3	96
Fish and fish products	0.6	0.9	0.1	0.5	0.2	16
Eggs and egg dishes	1.1	1.4	0.1	0.5	0.0	154
Cereal products	6.6	4.7	1.3	2.6	0.3	19
Vegetables (including roast and fried)	2.4	3.2	0.3	2.8	0.4	10
Fruit and nuts	0.1	0.3	0.0	0.2	0.0	0
Sugar, confectionery and preserves	1.3	0.6	0.2	0.1	0.0	0
Beverages	0.2	0.0	0.0	0.0	0.0	0
Others	1.2	0.9	0.1	0.5	0.0	5
Total	36.5	26.7	4.8	11.7	1.6	371

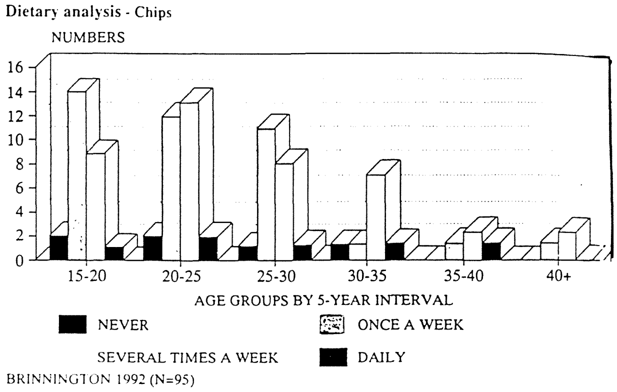

Figure 1
Dietary analysis - Chips

3. PROTEIN QUALITY: EFFECT OF FRYING

The nutritive value of food protein is a combination of both quality and quantity. Quality represents the proportion of protein eaten that is finally utilised by the body. Quantity represents the amount of protein present in food. There are several methods available to assay protein quality. These include PER (Protein Efficiency Ratio), BV (Biological Value), NPR (Net Protein Retention) and NPU (Net Protein Utilisation) (Miller & Payne 1955).

Thermal treatment of protein is known to reduce protein quality and the destruction of certain amino acids. Fish and chips (eaten together) still remains a popular meal choice in Britain, specially at weekends. Little work has been done on the changes in protein quality during fish frying. The assessment of protein quality in fried & steamed fish was performed using net protein utilisation (NPU). The method used was the comparative carcass assay of Miller & Bender (1955).

Weanling male Sprague-Dawley rats were given stock diet (RM1 expanded, SDS Ltd., Witham, Essex) for 7 days. At 30 days of age, groups of four were offered one of six diets that differed only in the type of fish and processing used. Diets contained 200g of fish protein, 550g carbohydrates (400g sucrose and 150g corn-meal), 50g mineral and vitamin mix and 200g fat/kg diet. The different fish species used were Cod and Plaice and the processing used was either steaming or frying. The fish were fried whole or enrobed in batter (made with wheat flour) prior to frying. Table VII shows the NPU values in fish that have undergone either frying or steaming. In both cases (Cod & Plaice) frying reduced NPU. It may be speculated that this reduction in NPU is due to the thermal destruction of some essential amino acids. Although a fall in NPU was noted in the fried fish compared to the steamed fish, interestingly, these changes in NPU could be reduced if the fish was covered with batter prior to frying. This represents a simple technique to retain the protein quality of fried fish. It is necessary to emphasise the preliminary nature of these studies. Further work is needed to optimise the frying conditions to retain protein quality in other foods.

Table VII

Net protein utilisation (NPU) values in steamed and fried fish

	NPU values*
Steamed Cod	83 ± 2.0
Fried Cod	74 ± 1.5
Steamed Plaice	84 ± 2.5
Fried Plaice	76 ± 1.0
Battered Cod	81 ± 1.5
Battered Plaice	83 ± 1.0

* Values are means with SD. n = 3 to 4 trials for each fish protein.

4. CONCLUSION

Fried foods have an unjustifiable reputation as being «bad» foods. This paper has shown, that eaten in moderation, they may provide important nutrients in our diet. Current eating habits and future trends suggest that fried foods are likely to only contribute a modest proportion of our total fat intake. Thus, fried foods should be seen within the total diet of a population rather than isolation.

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